



L76X GPS Module User Manual

OVERVIEW

This is a general GNSS module which supports Multi-GNSS systems: GPS, BDS, and QZSS, with advantages such as fast positioning, high accuracy, low power consumption, and so on.

SPECIFICATION

GPS

- Band: GPS L1(1575.42MHz), BD2 B1 (1561.098MHz)
 - Channels: 33 tracking ch, 99 acquisition ch, 210 PRN ch
 - C/A code
 - SBA: WAAS, EGNOS, MSAS, GAGAN
- Horizontal position accuracy:
 - Autonomous: <2.5mCEP
- Time-To-First-Fix @-130dBm (EASY™ enabled):
 - Cold starts: <15s
 - Warm starts: <5s
 - Hot starts: <1s
- Sensitivity:
 - Acquisition: -148dBm
 - Tracking: -163dBm
 - Re-acquisition: -160dBm
- Dynamic performance:
 - Altitude (max): 18000m
 - Velocity (max): 515m/s
 - Acceleration (max): 4G

GENERAL

- Communication interface: UART

- Baudrate: 4800~115200bps (9600bps by default)
- Update rate: 1Hz (default), 10Hz (max)
- Protocols: NMEA 0183, PMTK
- Power supply voltage: 5V / 3.3V
- Operating current: 11mA
- Operating temperature: -40℃ ~ 85℃
- Dimensions: 32.5mm x 25.5mm

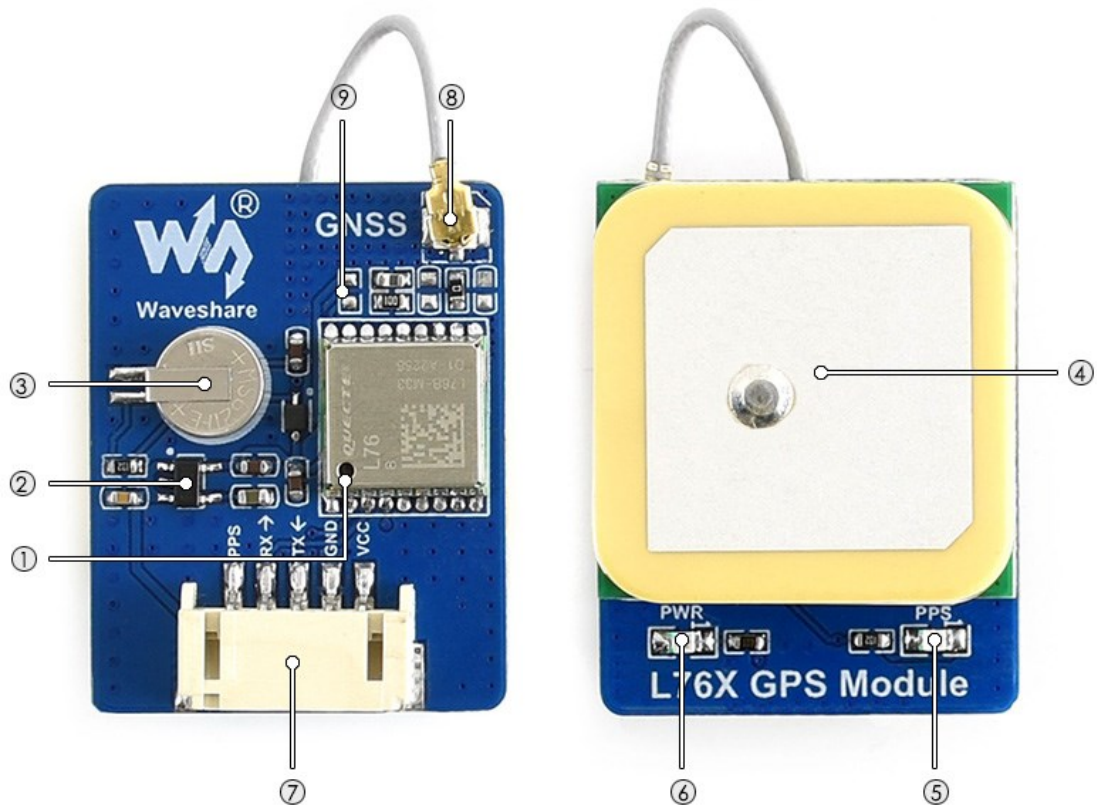
INTERFACE

PIN	Description
VCC	2.7V~5V
GND	Ground
TX	Serial data transmit
RX	Serial data receive
PPS	GPS status indicator (Pulses per seconds)

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HARDWARE



1. L76X GPS Module on board resource
2. L76B module
3. RT9193-33: power manager
4. Rechargeable MS621FE Li battery: for preserving ephemeris information and hot starts
5. Ceramics active antenna
6. GPS status indicator
7. Power indicator
8. PH2.0 5PIN connector
9. GNSS antenna connector
10. Backup mode wakeup jumper: not soldered by default, short the jumper to exit backup mode

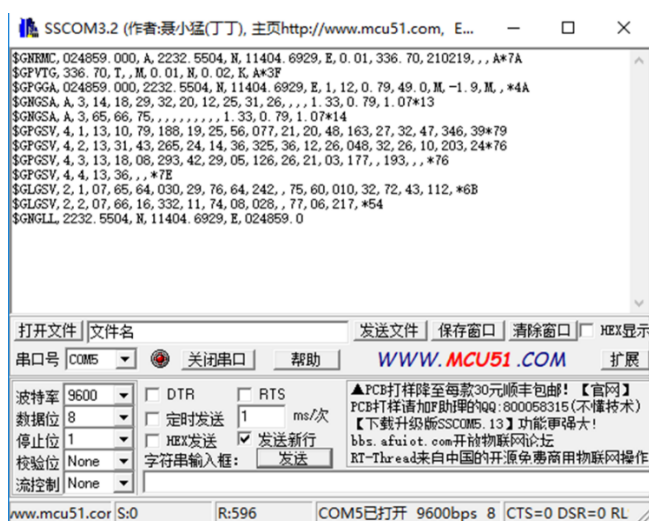
TESTING IN PC

Connect GPS antenna to L76X GPS module, and wire it to USB to UART module. Connect USB to UART module to PC. PWR lights on after connecting.



L76X GPS Module	CP2102 module
VCC	5V/3.3V
GND	GND
RX	TXD
TX	RXD
PPS	NC

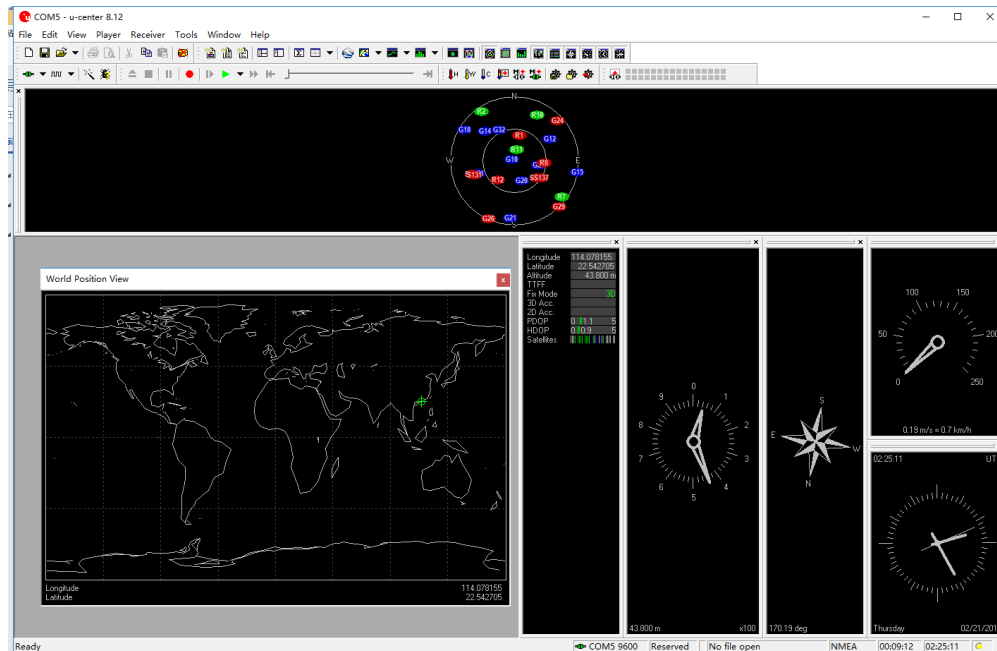
Open serial assistant software in PC. Select the correct COM port (according to the Device Manager), set baud rate: 9600, data bit: 1, stop bit: 1



【Note】

- a) Please set the module or receiver of antenna outdoor for stable GPS signal
- b) Generally, first time module should use about 35s to locate (cold starting), the locating time (first) maybe longer even failed because of environment, please be patient.

Download U-center software from wiki. Unzip it and install. Open U-center software, click Receiver menu, choose Port, and select the correct com port (refer to Devices Manager). Set baud rate: 9600 then click button to connect L76X GPS Module. U-center display information after connecting.



If you want to check the area better, you can install GoogleEarthPluginSetup.exe tool, which allow you to choose Google Earth under View menu

【Note】 The result you get from Google Earth maybe different with actual area because of dynamic drift of GPS

DEMO CODES

The demo code is set for 9600 and 115200 baudrate, make sure the baudrate of L76X GPS module is one of them if you use demo codes.

DOWNLOAD DEMO CODE

Find the product in Waveshare website, open the wiki and download demo code from wiki.

Resources [\[edit\]](#)

- [User Manual](#)
- [Schematic](#)

Demo code [\[edit\]](#)

- [Code](#)

Datasheet [\[edit\]](#)

Unzip:

名称	修改日期	类型	大小
Arduino	2019/2/20 18:03	文件夹	
RaspberryPi	2019/2/20 15:34	文件夹	
STM32	2019/2/20 15:35	文件夹	

Arduino: Arduino examples based on Arduino UNO

Raspberry Pi: Raspberry Pi examples include wiringpi and python codes

STM32: STM32 examples based on STM32F103

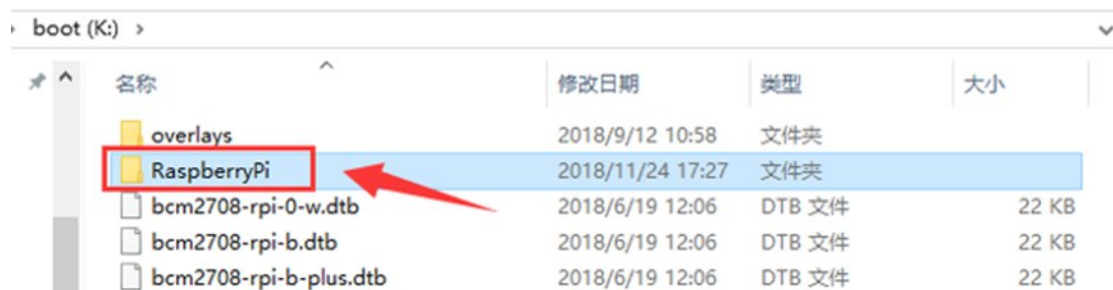
RASPBERRY PI EXAMPLES

COPY EXAMPLES

Insert SD card (which has installed Raspbian image) to PC by card reader



Copy Raspberry Pi examples (the folder we download and unzip above) to BOOT directory of SD card



Exit and insert the card to Raspberry Pi, then start.

Check it: `ls /boot`

```

pi@raspberrypi:~$ ls /boot/
bcm2708-rpi-0-w.dtb  bcm2710-rpi-3-b.dtb      config.txt      fixup_x.dat      kernel.img      start_cd.elf
bcm2708-rpi-b.dtb   bcm2710-rpi-3-b-plus.dtb  COPYING.linux  FSCK0000.REC    LICENCE.broadcom  start_db.elf
bcm2708-rpi-b-plus.dtb  bcm2710-rpi-cm3.dtb    fixup_cd.dat   FSCK0001.REC    LICENSE.oracle   start.elf
bcm2708-rpi-cm.dtb    bootcode.bin           fixup.dat      issue.txt        overlays        start_x.elf
bcm2709-rpi-2-b.dtb    cmdline.txt             fixup_db.dat   kernel7.img     RaspberryPi     System Volume Information
  
```

Copy it to /home/pi

```
sudo cp -r /boot/RaspberryPi/ ./
```

```
sudo chmod 777 -R RaspberryPi/
```

```

pi@raspberrypi:~$ sudo cp -r /boot/RaspberryPi/ ./
pi@raspberrypi:~$ ls
code  libcode  RaspberryPi  RPiLib  ubuntu  usbdisk
pi@raspberrypi:~$ sudo chmod 777 -R RaspberryPi/
pi@raspberrypi:~$ ls
code  libcode  RaspberryPi  RPiLib  ubuntu  usbdisk
  
```

LIBRARIES INSTALL

Examples should be used with libraries installed

Install **BCM2835**:

Download libraries from BCM2835 website:

<http://www.airspayce.com/mikem/bcm2835/>

```

sudo tar zxvf bcm2835-1.xx.tar.gz
cd bcm2835-1.xx
sudo ./configure
sudo make
sudo make check
sudo make install
  
```

【Note】 xx is the version of libraries, for example, if the libraries you download is bcm2835-1.52. The command you should execute is `sudo tar zxvf bcm2835-1.52.tar.gz`

Install **wiringPi**:

```

sudo apt-get install git
sudo git clone git://git.drogon.net/wiringPi
cd wiringPi
sudo ./build
  
```

Install **python**:

```

sudo apt-get install python-pip
sudo pip install RPi.GPIO
sudo pip install spidev
sudo apt-get install python-imaging
sudo apt-get install python-smbus
sudo apt-get install python-serial
  
```


ENABLE SERIAL PORT

UART interface should be used for communicating, so we need to enable hardware serial of Raspberry Pi.

sudo raspi-config

```

Raspberry Pi Software Configuration Tool (raspi-config)

1 Change User Password Change password for the current user
2 Network Options      Configure network settings
3 Boot Options        Configure options for start-up
4 Localisation Options Set up language and regional settings to match your location
5 Interfacing Options  Configure connections to peripherals
6 Overclock           Configure overclocking for your Pi
7 Advanced Options    Configure advanced settings
8 Update              Update this tool to the latest version
9 About raspi-config  Information about this configuration tool

<Select>                                <Finish>

```

```

Raspberry Pi Software Configuration Tool (raspi-config)

P1 Camera      Enable/Disable connection to the Raspberry Pi Camera
P2 SSH         Enable/Disable remote command line access to your Pi using SSH
P3 VNC         Enable/Disable graphical remote access to your Pi using RealVNC
P4 SPI         Enable/Disable automatic loading of SPI kernel module
P5 I2C         Enable/Disable automatic loading of I2C kernel module
P6 Serial      Enable/Disable shell and kernel messages on the serial connection
P7 1-Wire      Enable/Disable one-wire interface
P8 Remote GPIO Enable/Disable remote access to GPIO pins

<Select>                                <Back>

```

Disable login shell function and then enable hardware serial

```

Would you like a login shell to be accessible over
serial?

<Yes>                                <No>

```

```

Would you like the serial port hardware to be enabled?

<Yes>                                <No>

```

INSTALL MINICOM

minicom is a serial assistant tool for Linux.

Install minicom:

```
sudo apt-get install minicom
```

Using minicom:

```
minicom -D /dev/ttyS0 -b 9600
```

【Note】 If you use Raspberry Pi zero, the serial port should be ttyAMA0, you can confirm the port by command: `ls -l /dev/serial0` The default baud rate of minicom is 115200, here we use parameters -b 9600 to set it as 9600

```
Welcome to minicom 2.7

OPTIONS: I18n
Compiled on Apr 22 2017, 09:14:19.
Port /dev/ttyS0, 03:17:12

Press CTRL-A Z for help on special keys

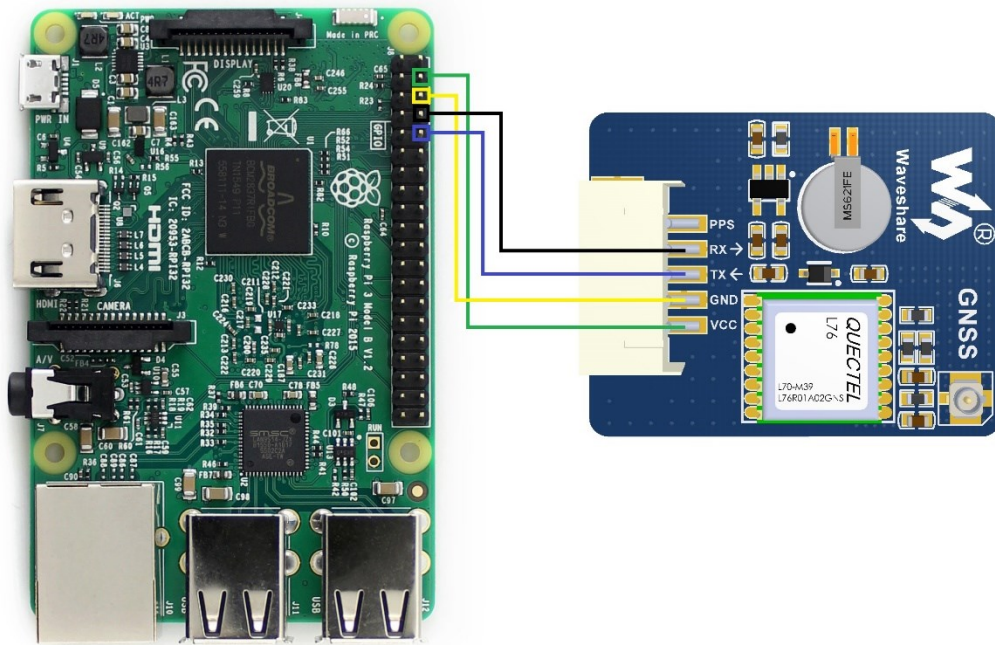
$GNRMC,031805.000,A,2232.5642,N,11404.6849,E,0.03,128.40,210219,, ,A*7D
$GPVTG,128.40,T,M,0.03,N,0.06,K,A*37
$GPGGA,031805.000,2232.5642,N,11404.6849,E,1,12,0.74,56.2,M,-1.9,M,,*40
$GNGSA,A,3,14,18,32,10,20,26,12,29,25,31,, ,1.41,0.74,1.19*15
$GNGSA,A,3,66,75,,,,,,,,,,,,,1.41,0.74,1.19*10
$GPGSV,4,1,13,10,64,180,28,32,54,003,38,25,49,055,22,31,48,285,38*76
$GPGSV,4,2,13,14,43,338,36,20,34,165,33,26,22,204,25,12,16,040,19*78
$GPGSV,4,3,13,29,10,114,18,18,08,280,22,22,04,321,38,51,,*4B
$GPGSV,4,4,13,193,,,*40
$GLGSV,2,1,06,65,72,072,,76,68,287,,75,44,015,32,72,33,130,*61
$GLGSV,2,2,06,66,28,337,22,77,18,226,*61
$GNGLL,2232.5642,N,11404.6849,E,031805.000,A,A*4F
█
```

If you want to exit, you can press Ctrl + A, press X and choose Yes, then Enter.

```
,,75,43,015,34,72,32,131,*68
,*66
02.000,A,A*4+-----+
4.6872,E,0.0|   Leave Minicom?   |
4           |   Yes   No       |
6872,E,1,14,+-----+
5,31,26,,1.21,0.71,0.98*1E
71,0.98*18
32,25,48,054,29,31,48,287,36*7E
```

HARDWARE CONNECTION

The color of wire you get may be different with here, you should connect the module according to the silk screen printing.



L76X GPS Module	Raspberry Pi (Board)	Raspberry Pi (BCM)
VCC	5V	5
GND	GND	GND
TX	10	P15
RX	8	P14

RUNNING CODES

Enter RaspberryPi folder (The directory of example) and run it with commands:

wiringPi code:

```
cd ~/RaspberryPi/wiringpi
sudo ./main
```

python code :

```
cd ~/RaspberryPi/python
sudo python main.py
```

EXPECTED RESULT

It requires about 35s to locate (first time).

Data printed first is original data.

Time: L76X GPS Module output time.

```
,1.10,0.78,0.78*1E
$GPGSV,4,1,13,10,58,179,25,32,56,010,41,42,50,127,,31,49,292,40*79
$GPGSV,4,2,13,14,46,343,36,25,46,051,31,20,30,165,32,26,26,205,30*7E
$GPGSV,4,3,13,12,13,038,27,29,12,111,23,22,08,320,41,18,07,276,*7A
$GPGSV,4,4,13,193,,,*40
$GLGSV,2,1,06,65,72,092,,76,67,303,,75,39,017,27,66,33,338,33*6E
$GLGSV,2,2,06,72,29,134,,77,21,231,*68
$GNGLL,2232.6312,N,11404.6593,E,032729.171,A,A*43
$GPZDA,032729.571,21,02,2019,,*53
$GNRMC,032729.571,A,2232.6331,N,11404.6643,E,0.58,297.14,210219,,,*72
$GPVTG,297.14,T,,M,0.58,N,1.08,K,A*30
$GPGGA,032729.571,2232.6331,N,11404.6643,E,1,12,0.78,131.9,M,-1.9,M,,*70
$GNGSA,A,3,10,32,31,14,25,20,26,12,22,29,,1.10,0.78,0.78*12
$GNGSA,A,3,66,75,,,,,,,,,1.10,0.78,0.78*1E
$GPGSV,4,1,13,10,58,179,23,32,56,010,41,42,50,127,,31,49,292,38

Time: 11:27:29
Latitude and longitude: 22.326331 N 114.046643 E
Baudu Coordinates 22.547066,114.089375
```

【Note】 Even the default baud rate of L76X GPS Module is 9600, it is changed to 115200 in code. If you find that 9600 cannot work next time, please check if it is changed.

STM32 EXAMPLES

The development board used here is Waveshare XNUCLEO-F103RB, whose chip is STM32F103RBT6. The code is based on HAL

HARDWARE CONNECTION

Wire L76X GPS Module to STM32 board, and connect USB to UART (USART1) interface of STM32 board to PC

L76X GPS Module	STM32
5V	5V
GND	GND
TX	PA10
RX	PA9

【Note】 Even the default baud rate of L76X GPS Module is 9600, it is changed to 115200 in code. If you find that 9600 cannot work next time, please check if it is changed.

EXPECTED RESULT

It requires about 35s to locate (first time).

Data printed first is original data.

Time: L76X GPS Module output time.



ARDUINO EXAMPLES

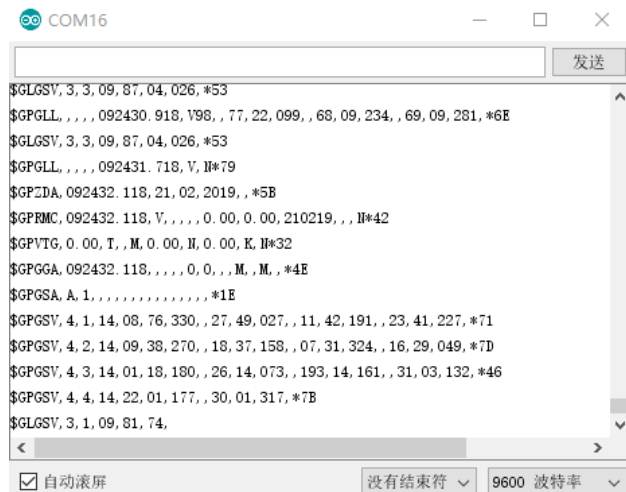
The development board used here is UNO PLUS

HARDWARE CONNECTION

L76X GPS Module	Arduino
5V	5V
GND	GND
TX	2
RX	3

EXPECTED RESULT

It requires about 35s to locate (first time). Open serial monitor and set baud rate to 9600. Data printed first is original data.



FAQ

1. Why the baud rate doesn't change after send changing command?

- Please check if the current baud rate is correct. If the satellites searched are too much, the module cannot allow the baud rate to be smaller. In this case, you can use SET_NMEA_OUTPUT command to reduce the output data per time and try again.

2. Why the locating is not accurate?

- The accuracy is influenced by environment. Weather reason: The humidity is very high when raining, which weakens the intensity of the GPS signal. It often rains in summer, therefore, the intensity of phone signals is weak. High building reason: high buildings shelter from satellite, make GPS intensity become weak. Area problem: Suburbs have less satellite coverage, so GPS intensity is weak in these areas. Interference problem: Sometime, signals from satellites will be interrupted by atmosphere ionosphere, buildings, forest, water and so on.

3. Why the locating result is different with smart phone?

- L76X GPS HAT use satellite locating. Smart phone use AGPS, LBS, WIFI and Bluetooth locating as well except satellite. Smart phone locate much faster. And the multi-satellite system used by smart phone are different with L76X's

4. How to exit from Backup mode?

- Module output nothing if it enters Backup mode. You cannot exit from Backup mode even re-power. The only way to exit from Backup mode is that short R6 more than 0.5s

